WHAT IS CLAIMED IS:

1. An illuminating-reflector system for transmitting first and second frequency bands for satellite and terrestrial communications, the system comprising:

a first reflector configured to transmit a first portion of the first frequency band in an dispersed beam, to reflect a second portion of the first frequency band, and to transmit the second frequency band;

a second reflector configured to reflect the second frequency band transmitted by the first reflector and to transmit the first portion of the first frequency band; and

a primary reflector configured to receive the second portion of the first frequency band reflected from the first reflector, to receive the second frequency band reflected from the second reflector, and to reflect the second portion of the first frequency band and the second frequency band in a substantially collimated beam.

2. The system of claim 1, further comprising control electronics disposed in a satellite bus and configured to control a transmission direction of the dispersed beam and the substantially collimated beam.

3. The system of claim 1, wherein the first reflector is disposed between the second reflector and the primary reflector.

4. The system of claim 1, wherein the dispersed beam is configured to be acquired by a satellite for initial acquisition and automatic tracking of the system.

5. The system of claim 1, further comprising a dispersive lens configured to receive the first and second frequency bands from a beam waveguide and transmit the first second frequency bands to the first reflector.

6. The system of claim 5, wherein the primary reflector includes an aperture formed therein to pass the first and second frequency bands from the dispersive lens to the first reflector.

7. The system of claim 5, wherein:

the dispersive lens is configured to disperse the first frequency band; and

a wavefront diameter of the first frequency band at the first reflector is approximately equal to a diameter of the first reflector.

8. The system of claim 5, wherein:

the dispersive lens is configured to disperse the second frequency band; and

a wavefront diameter of the second frequency band at the second reflector is approximately equal to a diameter of the second reflector.

9. The system of claim 1, wherein the first portion includes about five percent or less of the power the first frequency band.

10. The system of claim 1, wherein the second portion includes about ninety-five percent or more of the power of the first frequency band.

11. The system of claim 1, wherein the first frequency band includes at least one of the millimeter band, the microwave band, the Ka-band, and the V-band.

12. The system of claim 1, wherein the second frequency band includes a Ka-band.

13. The system of claim 1, wherein the primary reflector has a diameter of about six feet.

14. The system of claim 1, wherein the first reflector has a diameter of greater than or equal to about 4 inches.

15. The system of claim 1, wherein a gain of the primary reflector is greater than or equal to about 59 dB.

16. The system of claim 1, wherein a gain of the primary reflector is about 59.5 dB.

17. The system of claim 1, wherein a gain of the first reflector is less than or equal to about -33 dBi relative to a gain of the primary reflector.

18. A satellite for dual-frequency cross-link communications with at least one other satellite and at least one terrestrial-communications receiver, the satellite comprising:

a dual-frequency-illuminating reflector configured to transmit a first frequency band in a first collimated beam and in an dispersed beam and to transmit a second frequency band in a second collimated beam.

19. The satellite of claim 18, further comprising a satellite bus operatively coupled to the dual-frequency-illuminating reflector.

-- 20. The satellite of claim 19, further comprising control electronics disposed in the satellite bus and configured to slew the dual-frequency-illuminating reflector.

21. The satellite of claim 18, wherein the dispersed beam is a low-gain beam.

22. The satellite of claim 18, wherein the first and second collimated beams are high-gain beams.

23. The satellite of claim 18, wherein diameters of the first and second collimated beams are approximately equal.

24. The satellite of claim 18, wherein the dual-frequency-illuminating reflector includes:

a first reflector configured to transmit a first portion of the first frequency band in an dispersed beam, to reflect a second portion of the first frequency band, and to transmit the second frequency band;

a second reflector configured to reflect the second frequency band transmitted by the first reflector and to transmit the first portion of the first frequency band; and

a primary reflector configured to receive the second portion of the first frequency band reflected from the first reflector, to receive the second frequency band reflected from the second reflector, and to reflect the second portion of the first frequency band and the second frequency band in a substantially collimated beam.

25. The satellite of claim 24, wherein the first reflector is disposed between the second reflector and the primary reflector.

26. The satellite of claim 18, wherein the dispersed beam is configured to be acquired by another satellite for initial acquisition and automatic tracking of the first-mentioned satellite.

27. The satellite of claim 18, further comprising a dispersive lens configured to receive the first and second frequency bands from a beam waveguide and transmit the first second frequency bands to the first reflector.

28. The satellite of claim 27, wherein the primary reflector includes an aperture formed therein to pass the first and second frequency bands from the dispersive lens to the first reflector.

29. The satellite of claim 27, wherein:

the dispersive lens is configured to disperse the first frequency band; and

a wavefront diameter of the first frequency band at the first reflector is approximately equal to a diameter of the first reflector.

30. The satellite of claim 27, wherein:

the dispersive lens is configured to disperse the second frequency band; and

a wavefront diameter of the second frequency band at the second reflector is approximately equal to a diameter of the second reflector.

31. The satellite of claim 18, wherein the first portion includes about five percent or less of the power of the first frequency band.

32. The satellite of claim 18, wherein the second portion includes about ninety-five percent or more of the power of the first frequency band.

33. The satellite of claim 18, wherein the first frequency band includes at least one of the millimeter band, the microwave band, the Ka-band, and the V-band.

34. The satellite of claim 18, wherein the second frequency band includes a Ka-band.

35. The satellite of claim 18, wherein the primary reflector has a diameter greater than or equal to about six feet.

36. The satellite of claim 18, wherein the first reflector has a diameter of greater than or equal to about 4 inches.

37. The satellite of claim 18, wherein a diameter of the second reflector is between a diameter of the first reflector and a diameter of the primary reflector.

38. The satellite of claim 18, wherein a gain of the primary reflector is greater than or equal to about 59 dB.

39. The satellite of claim 18, wherein a gain of the primary reflector is about 59.5 dB.

40. The satellite of claim 18, wherein a gain of the first reflector is less than or equal to about -33 dBi relative to a gain of the primary reflector.